LTC Teletrak, Inc.

High Productivity Vacuum Blasting System

Technology Need:

The Department of Energy (DOE) deactivation and decommissioning (D&D) programs require cleanup of large quantities of concrete and steel surfaces. The goal is to render the concrete and steel as non-hazardous, so that the structures can either be used for normal occupancy, or demolished without creating vast amounts of hazardous wastes. Improved decontamination technologies are needed which demonstrate increased productivity and cost-effectiveness, while minimizing exposure to workers and secondary waste generation.

Technology Description:

LTC Teletrak, Inc. (LTC) improved a currently used decontamination technology, Vacuum Blasting, in order to meet this need. The practicability and success of Vacuum Blasting has been demonstrated for the decontamination of steel and concrete surfaces at nuclear facilities and other DOE installations. LTC's goal was to increase the technology's productivity by at least 50% by redesigning and improving existing vacuum components including blast nozzle, blasthead, wind curtain, dust separators and control sensors for both real time characterization and lift-off shutdown control.

Vacuum Blasting quickly removes surface coatings leaving an abraded substrate, while generating minimal waste (1% of conventional open blasting) and virtually no dust emissions. The blast nozzle is maintained much closer to the surface, capturing abrasive and debris with a built-in vacuum source. The blasthead interfaces with the cleaning surface in the form of a brush-ring. The main purpose of the brush-ring is to maintain negative pressure, with respect to the ambient air, allowing vacuum air flow of sufficient velocity

to transport the entrained particles. Additionally, LTC Teletrak redesigned the perimeter of the blasthead to contain six hollow screws which inject air to create a wind curtain trapping debris and abrasive for vacuum capture.

Productivity gains were achieved by redesigning the existing, circular blasting nozzle. Modeling of the air-abrasive flow inside the nozzle and blasthead, led LTC Teletrak to design an improved, rectangular blasthead. The rectangular design disperses grit particles more widely over its exit plane for greater surface coverage.

Further gains in productivity were made by designing a separation system that can accommodate a smaller abrasive. Smaller abrasive impacts the blast surface at a much higher speed, hence cleaning the surface better. However, smaller sized grit is more difficult to separate and recycle from the surface debris. Separation was redesigned to include both a pre-separator for large, low

density particles and a centrifugal separator for the finer particles .

Present vacuum blast heads are, in general, heavy and difficult and to handle. Wear testing of several materials resulted in the selection of the lightweight, Boron Carbide as the new liner to the rectangular blasting nozzle.

LTC's new blasthead incorporates radiological and proximity sensors. Radiological sensors located 180° apart indicate the level of contamination before and after cleaning. This provides real-time feedback to the operator on cleaning effectiveness. The proximity sensors are used with a pinch-off valve to cut off the flow of the blast-head when any significant separation of the blast-head and the surface occurs. This will prevent ineffective cleaning while the blast-head is in "lift-off" condition.

Benefits:

The technology offers a safe, economical and efficient means for cleaning up hazardous materials from many different types of surfaces. Benefits include:

<Increased productivity for cleanup of D&D contaminated facilities by more than 50% over baseline

<Minimal waste generation (1% of conventional open blasting) and virtually no dust emissions

<Minimized worker exposure to hazardous contaminants

<Improved ergonomics from lightweight construction of the blasthead

Status and Accomplishments:

The project has completed the third phase of a three phase contract. In Phases I and II, LTC developed mathematical models to simulate the entire process and used these results to design, manufacture and test an innovative rectangular nozzle, the blasthead incorporated with sensors and wind curtain, and two separators. Testing was done at LTC Teletrak's facility and the pre-prototype was tested at Florida International University's Hemispheric Center for Environmental Technology on coated steel plate and concrete wall. Numerical results agreed with experimental data showing an increase in productivity of 36% for the coated steel plate and 52% for the concrete wall. The newly designed centrifugal separator increased efficiency separation from 30% to 75%, even using finer abrasives.

In Phase III, LTC Teletrak designed and constructed two prototypes, one with a standard size nozzle and one with a large nozzle. Field verification testing of the High Productivity Vacuum Blasting System was performed at FIU-HCET's test facility again on coated steel plate and concrete wall. Results indicated that the productivity rate of the standard blasthead has been increased over 50% than that of baseline technology, and the productivity rate of the large blasthead provides a further increase near 100% over that of the newly designed standard blasthead (240% over standard baseline). The tasks of this project have been successfully completed and the goal of improving blasthead technology by more than 50% has been achieved.

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Online Resources:

Office of Science and Technology, Technology Management System (TMS), Tech ID # 2224
http://ost.em.doe.gov/tms

The National Energy Technology Laboratory Internet address is **http://www.netl.doe.gov**